

PROCESS AND APPARATUS FOR FORMING IMAGES

BACKGROUND OF THE INVENTION

Field of the Invention

5 [0001] The present invention relates to an image forming process for forming a protective layer of a thermoplastic resin film on a recording medium and an image forming apparatus for carrying out this process.

Related Background Art

10 [0002] In recent years, ~~the progress of the~~ ^{TECHNIQUE OF} ink-jet recording ^{HAS MADE} ~~technique is~~ ^{PROGRESS AND THE RESULTANT IMAGE} noteworthy ~~and its image quality~~ has reached a level equal or superior to that of a silver halide print. ^{A KNOWN} ~~AS TO~~ recording media used for this ink-jet recording process ^{INCLUDES} ~~those with~~ an image-receiving layer ^{ON A BASE MATERIAL SUCH AS PAPER} ^{THIS LAYER} containing porous particles excellent ^{AT} ~~in~~ absorbing and fixing recording liquid. ^{THIS TREATMENT IS ACHIEVED}

~~provided on a base material such as paper, are known.~~

^{ALSO UTILIZED IS} [0003] ~~Besides~~ a laminating treatment of a recorded image ^{IMAGE WHICH PROVIDES WATERPROOF CHARACTERISTICS, LIGHT RESISTANCE AND GLOSSINESS} by transferring and laminating a transfer layer, ~~which~~ comprising ^{ED OF LAYER OF} a thermoplastic resin layer ~~provided on a~~

base material, ~~onto a recorded image by heat and pressure adhesion to give waterproof, light resistance,~~

~~glossiness, etc. is also known.~~ By having a UV

absorbing agent contained in the transfer layer during

25 this treatment, it is also possible to provide ~~a~~ ^{A PRINT WITH} sufficient light resistance ~~to a print.~~ Furthermore,

~~by devising the material and~~ ^{CONSTRUCTION} ~~constitution of this~~

RESIN-USING

~~transfer layers~~ many laminating treatments of an image ~~HAVE BEEN~~
HAVE BEEN ESTABLISHED FOR ~~for simply and~~ easily providing the wear resistance, ~~WORKED OUT USING~~
~~solvent resistance, or the like, by use of a resin have~~ ~~A RESIN~~
BY DEVISING THE MATERIAL AND CONSTRUCTION OF THIS
LAYER.
~~been worked out thus far.~~

5 [0004] FIGS. 3A to 3C are schematic sectional views of a conventional laminating method. The film with a base material shown in FIG. 3A basically comprises a transfer layer 101 to be transferred and laminated onto the surface of a recorded image and a base material

10 film 102 for bearing the transfer layer 101. The transfer layer 101 can be peeled off from the base material^{FILM} 102 so as to be transferred and laminated onto the image-receiving layer of a recording medium after recording.

15 [0005] As shown in FIG. 3B, the transfer layer 101 is laminated while remaining borne on the base material film 102^{THE TRANSFER LAYER 101} so as to directly cover^{IS THEN} the top of the image-receiving layer 103a on an ink-jet image-receiving paper 103 after recording and applied onto

20 the image-receiving layer 103a by pressurization and/or fusion.

[0006] As shown in FIG. 3C, the base material^{FILM} 102 is peeled off from the transfer layer 101 after the transfer layer is applied onto the recorded image, and

25 the transfer layer 101 alone is left as a protective layer on the image-receiving layer 103a.

[0007] The principal problem of the construction

comprising a transfer layer 101 and a base material film 102, as shown in FIGS. 3A, 3B and 3C, is high cost. In a laminating treatment as ^{DISCUSSED} ~~mentioned~~ above, ~~as~~ ~~base material film comprising a heat resistant material~~ ^{MUST BE COMPRISED OF A HEAT RESISTANT MATERIAL} ~~is necessary for~~ the base material film 102 on which a resin layer to be transferred by heat and pressure adhesion on the recording side is formed by coating. ^{IN ADDITION, THIS BASE MATERIAL FILM 102 MUST EXHIBIT} ~~In this film, not only heat resistance but~~ flatness sufficient for giving the gloss of a protective film after the transfer, ~~is also required, thus resulting in~~ ~~high cost.~~ The cost of this base material film 102 ~~has~~ ^{IS HIGHER} ~~a much greater weight~~ ^{EITHER} than that of ^A a transfer material ^{WHICH REMAINS} ~~remaining~~ as a final product, or ~~that of~~ ^A ~~coating of a~~ transfer layer. ^{SOME} ~~Sufficiently stable and~~ deformation-free raw material ^{FOR} ~~is~~ ^{OF} a protective layer, ~~with~~ ^{AND IN WHICH PREANNEALING CONTROLS THERMAL SHRINKAGE,} under conditions assumed for the thermal transfer, ~~include~~ ^{AND} PET film, polyamide film, ^{AND} polyimide film, ~~and~~ ~~in each of these, preannealing controls~~ ~~so on with thermal shrinkage controlled by~~ ~~preannealing~~ ^{BUT EACH OF THESE MATERIALS IS OF} ~~but any of them is a high-cost material~~ ^{AND THUS} ~~With such a constitution,~~ a wide variety of ^{LOW-COST, GENERAL PURPOSE} applications ^{THAT ARE HIGH} ~~truly low in cost and highly general in~~ ^{APPLICATIONS} ~~purposiveness~~ are difficult to create.

[0008] The second problem of this ^{CONSTRUCTION} ~~constitution~~ ^{IS} lies in ~~that the base material film 102 becomes a used waste~~ ^{TO MINIMIZE} ~~From the viewpoint of processing cost~~ ^{OF} coating of ~~the~~ transfer layer 101 is ordinarily executed on a wide roll before slitting. ^{THUS,} ~~Thus,~~ recycling of used base

material film 102 cannot be directly performed.

BE LABOR ^{IF} ~~Supposing that~~ ^{BASE MATERIAL} ~~used basic film~~ ^{WERE WAS} ~~102 are recycled,~~ ^{IT} ~~they~~
^{RAW MATERIAL} ~~would be done on the level of raw materials.~~ ^{THERE WOULD} ~~Thus, it~~
^{FOR} ~~costs labor to collect~~ ^{ING} ~~and recycle~~ ^{ING} ~~them.~~ ^{IN ADDITION TO EXPENSES INCLUDING} ~~Besides a~~

5 mechanism for rewinding a film after the image transfer
in an apparatus, a space for ^{housing} ~~disposing~~ the mechanism, ^{AND} ~~a~~
^{OR CONTROL SYSTEM} ~~power source~~ ^{for moving the mechanism} ~~or control system~~
~~and so on are necessary.~~ ^{IF} ~~In a case where~~ a laminate
material has been cut, winding is unnecessary, but a
10 mechanism for carrying used ^{BASE MATERIAL} ~~basic~~ film 102 and
^{IT} ~~accumulating them~~ in a predetermined space is still
necessary.

[0009] The third problem of this ^{CONSTRUCTION IS} ~~constitution~~ lies in
that the function of a protective layer transferred and
15 formed varies according to ^{THESE FACTORS INCLUDING} ~~the~~ physical property,
^{IES AND} ~~surface property,~~ ^{thickness} ~~or the like.~~ These
especially affect the glossiness, the adhesion of a
film and the bubble releasability ~~to a great extent.~~
~~Originally,~~ the transfer process of a glossy protective
20 layer is a complicated process ^{TO} ~~in~~ which many parameters
contribute, ^{AND THE} ~~so that~~ addition of such ~~an~~ influential
variable factor ^{is} ~~is~~ unfavorable ~~to the stability of~~
~~phenomena.~~

25 SUMMARY OF THE INVENTION

[0010] ^{AN} ~~one~~ It is ~~one~~ object of the present invention to
provide an image forming process and an image forming

apparatus capable of solving the problems mentioned
above, ^{WHILE} ~~and~~ ^{A GLOSSY} forming an image ~~good in glossiness~~ ^A at low
cost and free of used wastes.

[0011] An image forming process according to the present
5 invention comprises the steps of conducting recording
on a recording medium with an image-receiving layer and
laminating a thermoplastic film onto the
image-receiving layer to smooth the surface of the
thermoplastic film by heating and pressurizing means.

10 [0012] An image forming apparatus according to the
present invention comprises: an ink-jet head for
conducting recording on a recording medium, ⁽¹⁾ a
laminating section for laminating a thermoplastic
polymer onto a recording medium on which recording has
15 been conducted, ⁽²⁾ ~~and heating and pressurizing means~~ ^{A MEANS} for
heating and pressurizing the thermoplastic film to
smooth the surface.

[0013] In the present invention, a thermoplastic resin
film ~~alone~~ is laminated without use of a base material
20 film, ~~that~~ ^{AS} has been ~~heretofore~~ ^{PREVIOUSLY} used, ⁽³⁾ ~~and~~ ^{ADDITIONALLY,} the surface of
a protective layer is smoothed during the lamination,
~~so that the cost can be reduced~~ ^{RESULTING IN A} ^{LOSTS} and a glossy fine
recorded image ~~can be obtained~~

[0014] ~~Besides, a film itself is laminated and heated from a~~
^{FURTHER, BY ELIMINATING THE BASE MATERIAL FILM, AND A}
25 heating means ^{APPLIES HEAT} is directly ^{APPLIED} ~~transmitted~~ ^{TO THE LAMINATED FILM,} not by way of a
~~base material film,~~ thereby reducing the thermal load
of the apparatus ~~or the like~~

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is an illustration of ^{AN} ~~one~~ example of an image forming apparatus according to the present invention.

5 [0016] FIGS. 2A and 2B are illustrations of ^{AN} ~~one~~ example of a device for manufacturing a thermoplastic film used in the present invention.

[0017] FIGS. 3A, 3B and 3C are illustrations of ~~one~~ ^{AN} example of ^A method for laminating a laminate film with a
10 base material attached.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] In the apparatus shown in FIG. 1, recording media 2-1 and 2-2, different in size, are fed from storing
15 cassettes 1-1 and 1-2 by means of first and second feed rollers 3-1 and 3-². Furthermore, through conveyance guides 7-1 and 7-2, rollers 4, a conveyance guide 8, rollers 5 and a conveyance guide 9, ^{RECORDING MEDIA 2-1 AND 2-2} they arrive at an ink-jet recording head 12. Here, in accordance with an
20 image signal from unshown image reader means, images are recorded on the image-receiving layer of the recording media 2-1 and 2-2. The ^{INK-JET} recording head 12 is composed of so-called multi-heads arranged in a full line, for example, nearly perpendicular to the
25 recording media 2-1 and 2-2, i.e. ^{PERPENDICULAR} ~~vertical~~ to the paper plane in FIG. 1. In this ink-jet recording, the recording media 2-1 and 2-2 are sucked ^{tioned} [ed] to a porous

the guide plate 14 by a suction fan 13^{THE GUIDE PLATE ACTS} to retain ~~their~~
~~of the recording media~~ ^{MAINTAIN AN ESTABLISHED}
planarity and ^{to} keep ~~their~~ gap ^{to} the recording head 12^{WITH} best.

THEN,
[0019] Furthermore, the recording media 2-1 and 2-2 after
5 recording are conveyed through a conveyance guide 10,
conveyance rollers 6 and a conveyance guide 11 to a
laminating section.

^{ADD FURTHER,}
[0020] ~~On the other hand~~ a long-scale thermoplastic
resin film 22 is wound onto a ^{DRUM-SHAPED} thermoplastic resin film
10 feed section 21 ~~in the shape of a drum~~. This
thermoplastic resin film 22 has a width corresponding
to a length perpendicular to the conveying direction of
the recording media 2-1 and 2-2. This thermoplastic
resin film 22 is fed from the feed section 21 through
15 feed rollers 23, a cutter 24, conveyance rollers 25 and
conveyance rollers 26 ^{WHERE IT} ~~and~~ overlapped ^{RECORDED} with the recording
media 2-1 and 2-2 ~~after recording~~ by means of rollers
27. Besides, the thermoplastic resin film 22 is ^{THEN TO} cut ~~at~~
a desired ^{LENGTH} position by means of the cutter 24.

20 [0021] Furthermore, ^{THE OVERLAPPED PORTIONS OF RECORDING MEDIA 2-1 AND 2-2 AND} ~~both of them overlapped by means of~~
^{THERMOPLASTIC RESIN FILM 22} ~~the rollers 27~~ are conveyed to pressurizing roller 28
^{WHICH CONTAINS} ~~containing~~ a heater 29 ^{THEN THEY ARE THEN} built in and heated and
pressurized for adhesion. ^{MORE SPECIFICALLY,} ~~Namely, onto the image~~
~~receiving layer of the recording media 2-1 and 2-2~~ the
25 thermoplastic resin film 22 is laminated and then
~~onto the image-receiving layer of the recording media 2-1 and 2-2~~
bonded. The laminated recording media 2-1 and 2-2 are
^{THEN} discharged through rollers 32 to a discharge tray 33.

[0022] Here, when smoothing the surface of the protective layer ^{FOR} ~~to~~ improve ^{ING} ~~the~~ glossiness of images, the pressurizing rollers 28 serving ^E as heating and pressurizing means ^{TO SMOOTH} ~~smooths~~ the surface on the side in contact with the thermoplastic resin film 22. In order to obtain glossy images, the surface roughness of the pressurizing rollers is preferably about 3 μm or less in terms of R_a and ^{wave} ~~much~~ preferably about 1.5 μm or less.

10 [0023] In the present invention, because of directly determining the glossiness of the transfer protective layer, ^{AND} ~~accordingly~~, of recorded images ~~X~~, the surface glossiness of ^{THE} rollers is an important factor. This glossiness ^{VARIES} ~~will vary~~ with image requirements, but a ^{GLOSSINESS} ~~generally is preferably~~ equal to or greater than 10% at an incident angle of 20° and ~~is~~ equal to or greater than 70% at an incident angle of 75° ~~X~~ IS GENERALLY PREFERRED.

[0024] ^{IN ADDITION,} Besides, the temperature of ^{SUPPLIED} heating by ^{THE} heating and pressurizing means ~~has to be determined appropriately~~ ^{WILL VARY WITH DIFFERENT COMPOSITIONS} depending on ^{MATERIAL COMPOSITIONS} ~~material~~ of ^{THE} thermoplastic resin film 22, but ~~is preferably in the~~ range of 60°C to 220°C is

ordinarily ~~X~~ PREFERRED.

20 ^{HEAT RESISTANT RUBBER IS} [0025] ^{FOR THE} The ^{PREFERRED} surface material of ~~this~~ pressurizing rollers ^{THE} pair 28 on the side of ~~a~~ thermoplastic resin film ~~is~~ preferably heat resistant rubber. With a metal roller, once flaws are generated on the surface, their shapes ^{BY APPLYING} are transferred, but ~~they are closed by~~ ^{TO} pressure in a

Title

RUBBER material ^{of rubber} ~~thus improving the durability~~ is significantly ^{IMPROVED} ~~Furthermore, from the viewpoint of mold~~ ~~releasability~~ ^{RED FOR MOLD RELEASABILITY} silicon rubber is preferable ~~and~~ ^{ALSO} applying traces of silicon oil is ^{FOR SIGNIFICANTLY} ~~significantly~~ ^{SIGNIFICANTLY} in point of maintaining and improving the mold releasability.

[0026] Devices ^{USED} for forming a protective layer ~~used~~ in the present invention are not limited to the example shown in FIG. 1. ^{IN ANOTHER POSSIBLE EMBODIMENT,} ~~For example,~~ a charged drum is used ^{AN} as ^{SO} intermediate carrier and a device ~~so~~ arranged ^{WRAPS THE} as to push this charged drum ~~wrapped with a~~ thermoplastic film 22 therearound to the recording media 2-1 and 2-2 ~~can be also employed.~~

[0027] Any thermoplastic film which can be laminated on a recorded image-receiving layer of a recording medium may be employed ^{AS THE} ~~for~~ thermoplastic resin films ~~used~~ in the present invention ~~without any limitation.~~ Thermoplastic resin films having preferable characteristics for lamination such as transparency, breaking strength and melting point have to be appropriately selected for use. Specifically, films of vinyl chloride-vinyl acetate copolymer, polyethylene, polypropylene, polyvinyl chloride, polystyrene, polyesters, polyvinyl alcohols, polyamides, cellulose acetate, polycarbonates, polyvinyl butyral, vinylidene chloride or the like can be ^{UTILIZED} ~~exemplified~~.

[0028] ^{ALSO,} ~~Besides~~ it is ^{PREFERRED} ~~preferable~~ either ~~that~~ the glass

transition point of ^{THE} thermoplastic resin film is lower than that of a binder resin of an image-receiving layer in a recording medium or that the film-forming temperature of ^{THE} thermoplastic resin film is lower than
5 that of a binder resin of an image-receiving layer in a recording medium, respectively.

[0029] The thickness of a thermoplastic resin film may be determined ^{SPECIFICALLY} appropriately, but ^{IT SHOULD BE OF} is preferably such thickness that the unevenness of the surface of the
10 image-receiving layer in a recording medium does not appear on the surface of the thermoplastic resin film. ^{SPECIFICALLY,} to be specific, ^A it is preferably in the range of 2 to 40 μm is preferred.

[0030] ^{FURTHER,} Besides, a thermoplastic resin film may be
15 composed of a laminate of different thermoplastic polymer layers. In this case, ordinarily, the glass transition point or film-forming temperature varies among the thermoplastic polymer layers. Thus, a thermoplastic layer ^{SIGNIFICANTLY} much lower in glass transition
20 point or film-forming temperature may be laminated onto the image-receiving layer. ^{Also} And in this case, the thickness of a thermoplastic polymer layer on the laminated side ^{OF} to the image-receiving layer ^{SHOULD} is preferably ^{BE OF} such thickness that the unevenness of the
25 surface of the image-receiving layer does not appear on the surface of the thermoplastic resin film. ^{Specifically, A} to be specific, ^{FOR SUCH A THERMOPLASTIC POLYMER LAYER THICKNESS,} it is preferably in the range of 1 to 20 μm is preferred.

^{WHILE}
~~Besides~~ the total thickness of ^{THE} ~~a~~ thermoplastic resin
film is preferably in the range ^{BETWEEN AND} of 2 ~~to~~ 40 μ m.

^{USING A POLYMER MATERIAL WITH A LOW GLASS TRANSITION POINT FOR}
[0031] By ^{setting} the polymer layer on the side directly
laminated onto an image-receiving layer, ~~to a material~~

5 ~~low in glass transition point~~ a resin can be ~~so~~
^{so} arranged as to firmly intrude into concave portions of
an uneven image-receiving layer, ~~on the other hand~~ ^{AND CONVERSELY} By ADDITIONALLY
using a polymer material ^{WITH A HIGH} ~~high in~~ glass transition point
and molecular weight for the layer on the opposite

10 side, the surface hardness of the laminate layer can be
enhanced. ^{A MULTIPLE LAYER} ~~Besides~~ such ^{composition of two layers or}
^{ALSO} ~~more~~ is ^{FOR} advantageous ~~also from the viewpoint of~~
preventing ~~the~~ inter-layer fusion in the stock of a
thermoplastic resin film ^{WHICH IS} wound in the shape of a roll.

15 [0032] FIGS. 2A and 2B are schematic illustrations
exemplifying a process for manufacturing a
thermoplastic resin film used in the present invention.

[0033] FIG. 2A shows an example of manufacturing a
monolayer thermoplastic resin film. As shown in FIG.

20 2A, a monolayer thermoplastic resin film is obtained by
supplying a thermoplastic resin material from a dye
coating head 51 to a casting roll 52 and winding a
shaped film on a winding roll 53. By using a casting
roll 52 in this manner, the film surface is well
25 smoothed, ^{THIS RESULTING IN} and images ^{FURTHER IMPROVED IN GLOSSINESS} after the formation of a
protective layer, ~~further improves in glossiness~~

[0034] FIG. 2B shows an example of manufacturing a double

layer thermoplastic resin film. As shown in FIG. 2B, a double layer thermoplastic resin film is obtained by supplying a thermoplastic resin material from a dye coating head 51 to a casting roll 52, ~~further~~ coating a second layer by means of a micro gravure coating head 54, drying the coat in a drying furnace 55, and winding the shaped film on a winder ^{ING} roll 53.

[0035] The examples shown in FIGS. 2A and 2B are so arranged ~~as~~ to wind a manufactured thermoplastic resin film in the shape of a roll and laminate this rolled thermoplastic resin film onto an image-receiving layer installed at the supply section 21 of the laminating apparatus shown in FIG. 1. ^{ANOTHER ARRANGEMENT} ~~but, a thermoplastic resin film may also be so arranged as to be~~ ^{COULD} continuously supplied ^{A THERMOPLASTIC RESIN FILM} from the casting roll 52 to the apparatus shown in FIG. 1 without being wound in the shape of a roll.

[0036] The image-receiving layer of a recording medium used in the present invention is mainly composed of porous inorganic particles and binder resin, ^{SUCH THAT} ~~where~~ 30 to 100 parts by weight, ^{BUT} preferably 50 to 500 parts by weight of binder resin, is employed with respect to 100 parts by weight of porous inorganic particles.

[0037] ^{FOR} ~~As to~~ porous inorganic particles, ^{PREFERRED ARE} those containing a large amount of pores having 3 to 30 nm diameter in the structure, ^{DESIRABLE ARE} ~~are preferable, especially~~ those having large pore density near the particle surface, ~~are~~

preferable. Furthermore, ~~from the viewpoint of~~ ^{for} obtaining a sufficient ink absorption rate, ~~or the like~~ the specific surface area of porous inorganic particles is preferably 50 m²/g or larger. ^{Also} Furthermore, ^{for} ~~in use of~~ high-speed ~~printing~~ ink-jet printer ⁽³⁾ the image-receiving layer of a recording medium preferably contains ^{A MINIMUM OF} 50% by weight ~~or more of~~ porous inorganic particles with ^A ~~the~~ specific area of 100m²/g or greater ^{FOR} ~~from the viewpoint of~~ preventing the overflow of ink ~~or~~ the like.

[0032] ^{FURTHER,} The porous inorganic particles endowed with such an ink solvent absorptivity and dye-molecule absorptivity preferably ~~take on~~ ^{ARE} white ^{IN} color, ~~further~~ ^{INCLUDES} As to the materials comprising porous inorganic particles having such characteristics, ^{AS WELL AS METAL} metals such as aluminum, magnesium and silicon, ^{AND} ~~and~~ oxides, hydrates, carbonates, ~~or the like of metals can be exemplified~~ Above all, synthetic silica is particularly ^{PREFERRED} ~~preferable~~ ^{DUE TO ITS} ~~on account of~~ excellency in all the characteristics mentioned above, established ^{USE IN} industrial production process, ⁽⁵⁾ inexpensiveness ⁽⁷⁾ and stability.

[0039] With an image-receiving layer comprising a mixture of such inorganic particles and an organic binder resin, ^{NOT QUITE} ~~not quite~~ small diameter ~~of~~ inorganic particles ^{ARE MORE PREFERRED FOR} ~~is preferable from the viewpoint of~~ ink absorptivity ~~or~~ the like. In many cases, inorganic particles in the range of 0.1 to 10 μm in diameter are employed and not

sufficiently small relative to the wavelength of light^⓪
~~so that~~ ^{THUS, A MATTED APPEARANCE RESULTS FROM} light scattering ^{takes place on the surface} ~~to~~
~~show a matted appearance~~ ^{WITHIN/OF THESE PARTICLES,} Among them, ultrafine

particles in the range of 0.1 to 1 μ m in diameter ~~CAN SOMETIMES~~

~~REDUCE MATTING~~ AND provide a glossy surface ~~rather reduced in matt in some~~

~~cases~~ but usually, a secondary aggregation of

particles occurs, so that the surface can [^]not be SUFFICIENTLY

smoothed ~~so much~~ ^{ALSO,} Besides, if a dispersant is added to

the coating liquid ~~for the purpose of~~ ^{TO} preventing the

10 aggregation, the absorptivity of ink ^{AND/OR} ~~or~~ the stability

of dye molecules are often damaged.

^{RESULTING}
[0040] For these reasons, the [^]surface of a recording
medium containing such porous inorganic particles ^⓪ in

15 which a high-speed absorptivity of ink and a coloring
stability of dyes have been ^{DESIRED ATTENDING} ~~investigated~~ is normally

matted. The present invention displays considerable

meritorious effects ^{FOR} ~~in the case of~~ using a recording
medium containing such image-receiving layers.

[0041] Hereinafter, examples of the present invention
20 will be described.

Example 1

[0042] Two parts of binder resin emulsion (Takamatsu
Yushi; NS120-XK) was added to ^{ONE} ~~1~~ part of silica

(Mizusawa Chemical Industries; Mizukasil P-50) ~~X~~

25 thereafter ^⓪ the mixture was dispersed to prepare a
coating liquid ^{IN WHICH} ~~so that~~ the solid content became 20% by
weight. This coating liquid was ^{THEN} ~~^~~ coated and dried onto A

fine paper of 186 g/m² ^{USING} ~~by means of~~ a slot-dye coater ^E ~~or so~~.
~~that a film~~ ^{AFTER} ~~after the~~ ^{THE FILM} ~~drying~~ ^A became 30 µm thick ~~to form~~
~~an~~ image-receiving layer.

[0043] Next, an 8 µm thick thermoplastic resin film made

5 of vinyl chloride-vinyl acetate copolymer was used ~~to~~
~~carry out~~ ^{FOR} ink-jet recording and the formation of a
protective layer ^{FOR THIS} ~~by means of~~ the apparatus shown in
FIG. 1. ^{WAS USED} The film-forming temperature of the film
10 material was 60°C. The temperature of pressurizing
rollers 28 having a silicon rubber surface during
lamination was set to 140°C and the glossiness of the
pressurizing roller 28 on the side of the thermoplastic
resin film was set to 80% at an incident angle of 75°.
^{EXCEPTIONALLY GLOSSY}
As a result, ^{WERE} ~~recording images excellent in glossiness~~ ⁹
15 ~~could be~~ obtained.

Comparative Example 1

[0044] The same vinyl chloride-vinyl acetate copolymer as
used in Example 1 was coated on a 38 µm thick
polyethylene terephthalate film with the same
20 thickness, thereby preparing a film with a base
material as shown in Figs. 3A to 3C. The unevenness of
the polyethylene terephthalate film was the same as
that of the pressurizing rollers used in Example 1.
Using this film, ink-jet recording and the formation of
25 a protective layer were carried out as in Example 1,
^{BT} ~~and~~ three times the heating energy of that in Example 1
was required ~~in order to~~ obtain the same glossiness as

in Example 1.

[0045] As clearly seen from the results of Example 1 and Comparative Example 1, the present invention does not use a film with a base material prepared by laminating a material for lamination onto a heat resistant film as in Example 1, but directly laminates only a material for lamination using rollers by heat and pressure adhesion, ^{THIS ACHIEVES} ~~which brings forth~~ high thermal efficiency and makes it possible to obtain ^{FAVORABLY GLOSSY} recorded images ~~having~~ good glossiness ^A at low cost.

Example 2
[0046] ^{FOR THE FOLLOWING, INK JET RECORDING AND FORMATION OF A PROTECTIVE LAYER WERE CARRIED OUT AS IN EXAMPLE 1} Except ~~that~~ a thermoplastic resin film comprising two layers of a 3 μ m thick ~~layer made of~~ low molecular weight acrylic resin and a 10 μ m thick layer of vinyl chloride-vinyl acetate copolymer was used, the temperature of pressurizing rollers 28 was set to 120°C and the side of vinyl chloride-vinyl acetate copolymer was brought into contact with the image-receiving layer. ~~ink jet recording and formation of a protective layer were carried out as in Example 1~~ ^{DESIRABLE} ~~good~~ results were obtained.

[0047] In this example, it is important to fully plasticize the acrylic resin layer ^{WITH} ~~by means of~~ the pressurizing rollers 28. Thereby, the lower vinyl chloride-vinyl acetate copolymer layer is sufficiently dissolved into the upper acrylic resin layer, ^{THUS MAKING} ~~so as to make~~ the interface disappear ^{THEREFORE,} and thus the density of

recorded images can be improved by eliminating the
light scattering on the interface between the above two
layers. ^{Also,} ~~Besides~~ the blocking of a relatively high Tg
acrylic resin layer is prevented so that a highly
uniform film is ^{OBTAINED} ~~completed~~.

[0048] As described above, according to the present
invention, a thermoplastic resin film without a base
material is laminated and the surface of a protective
layer is smoothed during laminating, so that a ~~good~~ ^{DESIRABLY}
glossy protective layer can be formed at a low cost and
without ^[used] waste.

[0049] Moreover, since a film itself is laminated and the
laminated film does not have a base material, ~~heat from~~
A heating means ^{IS} directly transmitted ^{THEREBY} ~~so that~~ thermal
load of ~~the~~ ^{THE} apparatus ~~or the like is reduced~~.